REMARKS

Applicants appreciate the attention given the present application by the Examiner. By this response, Applicants amend claims 16 – 23, 29, 31, 33, and 35 and withdraw claims 25, 34, and 36 with traverse.

Election / Restrictions

The Examiner alleges that claims 24, 34, and 36 are directed to an independent and distinct invention from that originally claimed. Applicants respectfully traverse this restriction.

This presently pending Application, is a national stage entry of a PCT application and is therefore governed by the PCT rules relating to unity of invention for purposes of claim restriction. PCT Rule 13 governs unity of invention under PCT, and Annex B of the PCT administrative instructions discusses how rule 13 is to be applied. In pertinent part, Annex B.(e) states that "the method for determining unity of invention under Rule 13.2 shall be construed as permitting, in particular, the inclusion of any one of the following combinations of claims of different categories in the same international application: ... (ii) in addition to an independent claim for a given process, an independent claim for an apparatus or means specifically designed for carrying out the said process."

Applicants therefore respectfully submit that restriction of these claims is not proper under PCT practice as they relate to an apparatus specifically designed for carrying out the currently claimed methods in the present Application. Accordingly, reconsideration and withdrawal of this restriction requirement is respectfully requested.

35 U.S.C. § 112 Rejection

Claims 16 - 23 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Insofar as it pertains to the presently pending claims, Applicants respectfully traverse this rejection.

Applicants hereby amend these claims to more clearly indicate that these claims serve to further define the recycling portions of their respective base claims. Although Applicants have amended the claim to overcome the Examiner's concerns, Applicants nonetheless note that these concerns do not properly render any claim indefinite under 35 U.S.C. §112. Further, Applicants' amendments do not narrow the scope of claims 16 – 23.

At least in view of the above, Applicants respectfully submit that the claims as presented in this Response satisfy the requirements of 35 U.S.C. §112, second paragraph. Accordingly, reconsideration and withdrawal of this rejection is respectfully requested.

Claim Rejections under § 102(e) and § 103(a) – Dresselhaus and Resasco

Claims 14 – 23, 26 – 33, and 35 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent 6,919,064 to Resasco ("Resasco") in view of Dresselhaus, et al. *Science of fullerenes and carbon nanotubes*, 756-776 (Academic Press 1996) ("Dresselhaus"), which the Examiner alleges is only used to show a state of fact. The above claims also stand rejected in the alternative under 35 U.S.C. §103(a) as obvious over Resasco in view of Dresselhaus. Insofar as they pertain to the presently pending claims, these rejections are respectfully traversed.

Claim 33

Independent claim 33 pertains to a method for producing fine carbon fiber. The method comprises, in pertinent part, "first collecting fine carbon fiber resulting from said thermal decomposition from reacted reaction gas with a first fine carbon fiber-separating and collecting apparatus, wherein said fine carbon fiber is separated from said catalyst prior to first collecting; cooling said reacted reaction gas after said first collecting by passing said reacted reaction gas through a gas-cooling apparatus; second collecting fine carbon fiber resulting from said thermal decomposition from the cooled reacted reaction gas with a second fine carbon fiber-separating and collecting apparatus; and recycling part of the cooled reacted gas after second collecting by

passing said cooled reacted gas through a gas-recycling apparatus for subsequent thermal decomposition cycles."

Among the deficiencies of Resasco, Applicants specifically point out that Resasco contains no teaching or suggestion of a two-step carbon nanotube collection process with an intermediate cooling step between the collections. Specifically, the only cooling process described or contemplated by Resasco is performed while the carbon fibers are still attached to the catalyst particles (Col. 11, lines 9 – 31). All fine carbon fiber collection and purification steps contemplated or taught by Resasco occur after this catalyst cooling process (Col. 11, lines 56 – 61), and no process of further cooling of the carbon fibers or reaction gases after catalyst removal is discussed. Applicants therefore respectfully submit that Resasco makes no teaching or suggestion of "first collecting fine carbon fiber resulting from said thermal decomposition from reacted reaction gas with a first fine carbon fiber-separating and collecting apparatus, wherein said fine carbon fiber is separated from said catalyst prior to first collecting [and] cooling said reacted reaction gas after said first collecting" as required by independent claim 33.

The Office Action does not rely on Dresselhaus to teach any portions of the two-stage collection with intermediate cooling aspect of independent claim 33, nor does Dresselhaus contain any such teachings, being instead concerned only with structures and arrangements of carbon nanotubes and related structures. Applicants therefore respectfully submit that Resasco and Dresselhaus are both individually deficient in their teaching with respect to independent claim 33 and that neither remedies the deficiencies of the other if combined (assuming the references may be combined, which Applicants do not admit). Specifically, neither Resasco nor Dresselhaus teach or suggest a two-stage fine carbon fiber collection process with an intermediate cooling phase, where collection and cooling are both carried out after catalyst separation.

Claim 35

Independent claim 35 also pertains to a method of producing fine carbon fiber. The method of claim 35 requires, in pertinent part, "first collecting fine carbon fiber from reacted reaction gas passing through a first fine carbon fiber-separating and collecting apparatus, wherein said fine carbon fiber is separated from said catalyst prior to first collecting; first cooling the reacted reaction gas with a first reacted gas-cooling apparatus after first collecting; second collecting fine carbon fiber from the first cooled reaction gas with a second fine carbon fiber-separating and collecting apparatus; second cooling the reacted reaction gas after collecting with a second reacted gas-cooling apparatus to separate condensate from said gas; recycling the second-cooled reacted gas with a gas-recycling apparatus, wherein water and high boiling point by-products are separated from condensate formed during second cooling by a moisture separator; and recycling unreacted raw material organic compound separated from the reacted gas during second cooling or moisture separation."

Applicants respectfully submit that Resasco and Dresselhaus are both individually deficient in their teaching with respect to independent claim 35 and that neither remedies the deficiencies of the other if combined (assuming the references may be combined, which Applicants do not admit) for at least the same reasons as set forth above with respect to independent claim 33. Specifically, Applicants respectfully submit that because, as noted above, neither Resasco nor Dresselhaus teach or suggest a two-stage fine carbon fiber collection process with an intermediate cooling step, they cannot teach or suggest "first collecting fine carbon fiber from reacted reaction gas passing through a first fine carbon fiber-separating and collecting apparatus, wherein said fine carbon fiber is separated from said catalyst prior to first collecting; first cooling the reacted reaction gas with a first reacted gas-cooling apparatus after first collecting; second collecting fine carbon fiber from the first cooled reaction gas with a second fine carbon fiber-separating and collecting apparatus" as required by independent claim 35.

Claims 29 – 32

Claims 29 to 32 all contain the limitation that "the fine carbon fiber comprises a single-walled carbon nanotube ... which has an axial chiral structure." The Office Action states that no patentable weight is given to the "axial" aspect claimed. Specifically, the Office Action attempts to dismiss out of hand this terminology as "some lost in translation word that might mean something in Japanese." (Page 6 of Office Action). Applicants respectfully refer the Examiner to the IUPAC Compendium of Chemical Terminology. Applicants respectfully note that the term "axial chirality" is defined in the IUPAC Compendium of Chemical Terminology and other sources. Specifically relating to carbon nanotubes, and as discussed in Dresselhaus, axial chirality refers to a geometry whereby a nanotube exhibits a spiral symmetry whose mirror image cannot be superposed on the original one. Specifically taught by Dresselhaus is the fact that armchair and zigzag nanotubes are *achiral* tube types because they "exhibit a mirror symmetry plane normal to the tubule axis." (Dresselhaus at 757 and 758) Applicants respectfully submit that the Examiner has improperly disregarded essential terms of these claims. The Examiner's assertion that "axial chiral structure says nothing" is patently false since "axial chiral structure" clearly and specifically relates to particular types of tube structures. Furthermore, Dresselhaus clearly implies that different reaction and growth conditions will favor the production of chiral or achiral nanotubes (Dresselhaus at 775), and that axially chiral and achiral nanotubes have different physical properties (Dresselhaus at 760), so specifying that a nanotube has or lacks axial chirality defines the presence or absence of certain physical properties of the tube and also implies the presence or absence of certain production techniques that favor the production of axially chiral nanotubes as opposed to achiral ones. Resasco makes no discussion or distinction regarding the chiral structure of tubes produced and Dresselhaus does not discuss the production of chiral vs. achiral nanotubes except to imply that the production processes for chiral and achiral nanotubes are different.

Summary

For at least the reasons stated above, Applicants respectfully submit that Resasco and Dresselhaus are both individually and jointly (assuming the references may be combined, which Applicants do not admit) deficient in their teachings with respect claims 33 and 35 and all claims depending therefrom.

No inherent chiral properties

Applicants respectfully submit that Dresselhaus contains no teaching regarding the inherency of chiral properties in a carbon nanotube, and instead clearly shows that axial chirality is neither inherent nor required in a carbon nanotube. Applicants therefore respectfully submit that the section 102(e) rejection is improper because it attempts use the substantive teachings of a secondary reference.

Section 102 deficiencies

Applicants respectfully submit that having failed to teach a two-stage fine carbon fiber collection process with an intermediate cooling step, and having failed to discuss or otherwise identify the presence or absence of axial chiral symmetry in nanotubes produced, Resasco is clearly deficient under a section 102 analysis.

Section 103 deficiencies

Applicants further submit that even if Dresselhaus could properly be combined with Resasco (which Applicants do not admit), the above-identified deficiencies in the production process taught by Resasco are not in any way addressed by Dresselhaus. Applicants therefore submit that the Office Action fails to establish *prima facie* obviousness under a section 103 analysis.

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Accordingly, reconsideration and withdrawal of these rejections is respectfully requested.

Claim Rejections under § 103(a) – Dresselhaus , Bower, Choi, Smalley, and Resasco

Claims 14 – 23, 26 – 33, and 35 stand rejected under 35 U.S.C. §103(a) as being anticipated by Resasco in view of Dresselhaus, in further view of U.S. Patent 6,761,870 to Smalley ("Smalley), Choi et al., *Controlling the diameter, growth rate, and density of vertically aligned carbon nanotubes synthesized by microwave plasma-enhanced chemical vapor deposition*, Applied Physics Letters 2000; 76(17): 2367-2369 ("Choi"), and Bower et al., *Nucleation and growth of carbon nanotubes by microwave plasma chemical vapor deposition*, Applied Physics Letters 2000: 77(17): 2767-2769 ("Bower"). This rejection is respectfully traversed.

Of the additional references applied, only Smalley touches on the product recovery and gas recycling aspects of a fine carbon fiber production process. Insofar as Smalley addresses these issues, it is only to say that "the solid product is removed from the gas stream by any suitable means and the separated gas stream can be recycled." (Col. 8, lines 45 – 47). Applicants respectfully submit that this statement by Smalley shows that Smalley is wholly unconcerned with, and dismissive of, the product recovery and gas recycling aspects of a fine carbon fiber process. Smalley contains no teaching or suggestion of a two-stage fine carbon fiber collection process with an intermediate cooling phase, where collection and cooling are both carried out after catalyst separation, as required by both independent claims 33 and 35. Applicants therefore respectfully submit that even if Smalley and Resasco can be combined (which applicants do not admit) Smalley does not remedy the above-stated deficiencies of Resasco with respect to independent claims 33 and 35 and all claims depending therefrom.

Applicants respectfully submit that both Choi and Bower only teach physical properties of carbon nanotubes and nanotube formation and therefore are only tangentially relevant to the present invention. Specifically, neither Choi nor Bower contain any discussion of a two-stage fine carbon fiber collection process with an intermediate cooling phase, where collection and

cooling are both carried out after catalyst separation. Applicants therefore respectfully submit that Choi and Bower are not relied upon, nor can they properly be relied upon, to remedy the previously stated deficiencies of Resasco with respect to independent claims 33 and 35 and all claims depending therefrom.

At least in view of the above, Applicants respectfully submit that none of the above references, taken either alone or in combination (assuming the references may be combined, which Applicants do not admit) teach or suggest either "first collecting fine carbon fiber resulting from said thermal decomposition from reacted reaction gas with a first fine carbon fiber-separating and collecting apparatus, wherein said fine carbon fiber is separated from said catalyst prior to first collecting; cooling said reacted reaction gas after said first collecting by passing said reacted reaction gas through a gas-cooling apparatus; second collecting fine carbon fiber resulting from said thermal decomposition from the cooled reacted reaction gas with a second fine carbon fiber-separating and collecting apparatus" as required by claim 33 or "first collecting fine carbon fiber from reacted reaction gas passing through a first fine carbon fiber-separating and collecting apparatus, wherein said fine carbon fiber is separated from said catalyst prior to first collecting; first cooling the reacted reaction gas with a first reacted gas-cooling apparatus after first collecting; second collecting fine carbon fiber from the first cooled reaction gas with a second fine carbon fiber-separating and collecting apparatus" as required by independent claim 35. Applicants therefore respectfully submit that the Office Action fails to establish *prima facie* obviousness of claims 14 – 23, 26 – 33, and 35 and respectfully request reconsideration and withdrawal of this rejection.

Conclusion

In view of the above remarks, it is believed that claims are allowable.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Michael K. Mutter, Reg. No. 29,680, at the telephone number of the undersigned below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

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If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

Dated: August 28, 2008

Respectfully submitted,

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